MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

ECE2066 – OPERATING SYSTEMS

(ME, CE)

27 OCTOBER 2017
9:00 A.M. - 11:00 A.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of 6 pages with 4 questions only.
2. Answer **ALL** the 4 questions. The distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (25 marks)

(a) With the help of suitable examples, differentiate between **program** and **process**.
[3 marks]

(b) Based on the 7-state process model, describe a situation for which the following state transitions will occur.

(i) Running → Ready
[2 marks]

(ii) Blocked → Ready
[2 marks]

(iii) Ready → Ready Suspend
[2 marks]

(iv) Running → Ready Suspend
[2 marks]

(c) A Process Control Block (PCB) is a collection of attributes needed by the operating system to control the process. Name and discuss THREE (3) types of information which are managed by the PCB.
[6 marks]

(d) Four jobs listed in Table Q1(d) are to be executed on a single processor computer with 2048 MB of memory. The jobs can be implemented either using the uniprogramming and multiprogramming scheme. Assume that virtual memory is not used in the case of multiprogramming. Compare the jobs implemented in both uniprogramming and multiprogramming in terms of the following:

(i) Processor usage (%).
[2 marks]

(ii) Memory usage (%).
[2 marks]

(iii) Throughput (number of jobs per hour).
[2 marks]

(iv) Mean response time.
[2 marks]

Continued...

Table Q1(d): Job descriptions

	JOB 1	JOB 2	JOB 3	JOB 4
Type of job	Heavy I/O	Heavy I/O	Heavy I/O	Heavy computation
Processor usage	10%	5%	10%	60%
Duration	10 minutes	20 minutes	25 minutes	30 minutes
Memory required	100 MB	300 MB	200 MB	500 MB
Printer usage	Yes	No	No	Yes

Continued...

Question 2 (25 marks)

(a) By using a suitable example, discuss the potential problems faced by concurrent execution of threads in a multi-threaded application due to the race condition.

[6 marks]

(b) Mutual exclusion is a way to ensure that if one process is using a shared modifiable data, the other processes will be refrained from accessing the same data. Explain any FOUR (4) requirements for mutual exclusion.

[8 marks]

(c) Semaphore is one of the solutions to mutual exclusion. Describe in detail the operations that can be performed on a semaphore.

[5 marks]

(d) Consider the following snapshot of a system. Determine whether deadlock is detected on the system.

Table Q2(d).1: Available resources in the system

	Resources			
	R1	R2	R3	R4
Quantity	2	1	0	0

Table Q2(d).2: Resources assigned to the processes

Process	Resources			
	R1	R2	R3	R4
P1	0	0	1	0
P2	2	0	0	1
P3	0	1	2	0

Table Q2(d).3: Resources still needed by the processes

Process	Resources			
	R1	R2	R3	R4
P1	2	0	0	1
P2	0	0	1	0
P3	2	1	0	0

[6 marks]

Continued...

Question 3 (25 marks)

(a) Discuss each of the following criteria in the context of CPU scheduling.

(i) CPU utilization

[2 marks]

(ii) Throughput

[2 marks]

(iii) Waiting time

[2 marks]

(b) Suppose that four processes (P1, P2, P3, and P4) arrive at time 0 and are ready to be executed. Table Q3(b) shows the burst time of the processes:

Table Q3(b)

Processes	Burst Time (millisecond)
P1	3
P2	7
P3	8
P4	6

(i) Describe the operation of each of the following scheduling algorithm. Then apply the algorithms for the processes in Table Q3(b). Draw the respective Gantt Chart which shows each process's schedule. Show the working steps.

(I) First-Come, First-Served (FCFS).

[3 marks]

(II) Shortest-Process-Next (SPN).

[3 marks]

(III) Highest-Response-Ratio-Next (HRRN).

[7 marks]

(ii) Calculate the average waiting time for each of the algorithm in Q3(b)(i).

[3 marks]

(iii) Compare FCFS, SPN, and HRRN scheduling algorithms.

[3 marks]

Continued...

Question 4 (25 marks)

(a) Describe THREE (3) categories of input/output (I/O) devices. Give an example for each category.

[6 marks]

(b) A file system is used to control how data is stored and retrieved. Name THREE (3) modern file systems.

[3 marks]

(c) Suppose a file system adopts the size of 4 kilobyte block size. With the help of suitable diagrams, explain how two files of 12 kilobyte and 20 kilobyte may be stored using each of the following disk blocks allocation techniques:

(i) Contiguous allocation.

[4 marks]

(ii) Chained allocation.

[4 marks]

(iii) Index-node (i-node).

[4 marks]

(d) Consider a file system that uses in-memory file allocation table for indexing the disk blocks. Each table entry requires 4 bytes of storage. For a 4 terabyte disk and a 4 kilobyte block size, calculate the maximum memory size required to hold the file allocation table. Next, discuss the suitability of in-memory file allocation table for a system with large disks.

[4 marks]

End of paper